Bidirectional full SiC 200 kW DC-DC Converter for Electric, Hybrid and Fuel Cell Vehicles

Winner of the Semikron Innovation Award 2015
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Description

In electric and hybrid vehicles many compromises have to be accepted to avoid different HV-levels and a lot of extra money and effort is spent, to keep input and output voltage ranges as wide as possible to match different applications.

Fraunhofer IISB offers non-isolating HV-DC-DC Converters that match all different occurring voltage levels saving space and costs and offering more degrees of freedom for the vehicle designers.

The Fraunhofer engineers have managed to design an extreme lightweight, small and powerful DC-DC Converter based on SiC-Mosfets, extremely flat and small gate drivers, full ceramic capacitors and custom made low-weight ferrite inductors.

The unique design has been awarded by the Semikron foundation with the innovation award 2015.

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowside Voltage Range $V_{LV}$</td>
<td>50 - 790 V</td>
</tr>
<tr>
<td>Highside Voltage Range $V_{HV}$</td>
<td>$(V_{LV} + 10 V) - 800 V$</td>
</tr>
<tr>
<td>Lowside Current</td>
<td>300 A</td>
</tr>
<tr>
<td>Maximum Output Power @ 667 V Lowside Voltage</td>
<td>200 kW</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>200 kHz</td>
</tr>
<tr>
<td>Dimension</td>
<td>248 x 135 x 42 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>3.2 kg</td>
</tr>
<tr>
<td>Power density</td>
<td>up to 143 kW / dm³</td>
</tr>
<tr>
<td></td>
<td>up to 62 kW / kg</td>
</tr>
<tr>
<td>Efficiency</td>
<td>up to 98.9 %</td>
</tr>
</tbody>
</table>

Features

- Outstanding power density
- High efficiency
- Wide input and output voltage range
- High switching frequency
- Modular setup (can be extended easily)
- Extremely low inductive setup
- Optimized water cooled thermal design
- Low weight
- Sintered power modules for long lifetime
- Small, fast and robust gate drivers
- Full SiC power electronics
- Six interleaved phases
- Hardware over-/ undervoltage lockout
- Over current protection
- Winner of the Semikron Innovation Award 2015

Efficiency Data

Efficiency in step down mode

- 800V -> 667V
- 650V -> 288V

Efficiency vs. Current

[Graph showing efficiency vs. current]